EPITOME
ON
BLOOD PRESSURE

BURTON BAKER GROVER, M. D.

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EPITOME

ON

BLOOD PRESSURE

Aids to the interpretation of Blood Pressures

for

The General Practitioner

WITH KEY TO DIAGNOSIS

BY

BURTON BAKER GROVER, M. D.

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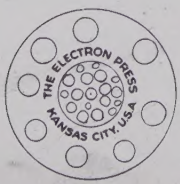

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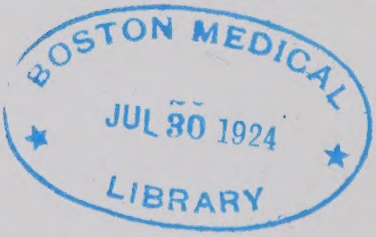


PREFACE

IT is the custom of many, writing upon the subject of blood pressure, to refer to the insipid analogy of the mechano-hydraulic simile for the left side or inner circuit of the heart; the pump (heart), the outlet valve (semilunar valve), the compression chamber (aorta), the mains (arterioles ending in capillaries), the return drains (venous vessels with valves), the reservoir (auricle), and the inlet valve (Auriculo-ventricular valve). This picture is useful only for one purpose,—to convey a quick impression of the cardio-vascular system as an **independent** entity.

But the cardiovascular system does not exist in the body for the purpose of satisfying itself alone. It is a system subservient to the many needs of the multiple tissues that require the materials carried by the blood. At all times it acts in the interest of and is influenced by the behavior of these tissues. So that the earliest derangement of the cardiovascular system really begins in the tissues.

Owing to the unusual flexibility of the cardio-vascular unit, the transient tissue disturbances in-

duce but fleeting deviations in the action of the heart and vessels. If the tissue damage is more permanent, then the heart and vascular derangements become compensatingly permanent. I think this concept is important, for it stresses the imperative necessity to be ever vigilant in detecting the **earliest possible** alterations in the cardio-vascular fitness of the individual.

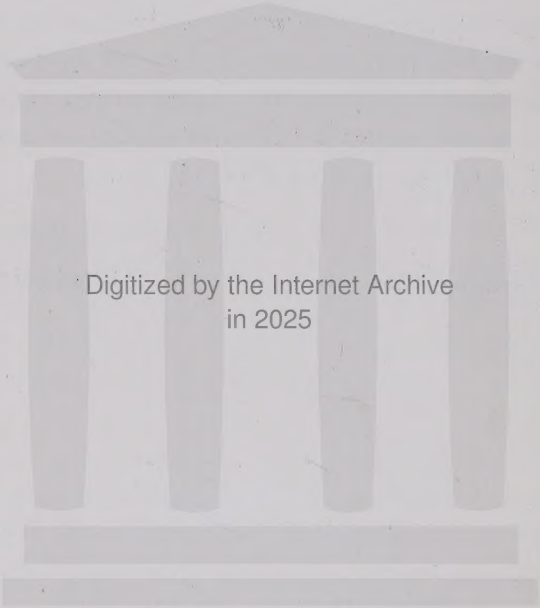
Here, then, Doctor Grover has done us a great service. I take it that what Doctor Grover so aptly calls "hyperpiesia" is exactly the warning syndrome that makes it possible to appreciate an **early premonition** suggesting impending transition to subsequent permanent damage, and to which there has been given the name "hypertension." From the viewpoint of therapeutic possibility, hyperpiesia is signally more important than hypertension, for reasons that are necessarily obvious.

With these basic considerations constantly in mind, it is refreshing, enlightening and progressively scientific to have these lucid and lucent epitomized aphorisms, each one obviously representing the completed crystal that separates only from a properly concentrated and long standing experience.

There is nothing to subtract from the essay, and it is certain that Doctor Grover's epitome cannot fail to interest all workers in cardiology; but its truer usefulness lies in carrying important messages to the general practitioner who, being destitute of facilities for acquiring expert guidance in cardiologic inquiry, must rest content to have clear, concise and collected information that is immediately pertinent to clinical requirements.

A. J. PACINI, M. D.,

Chicago, 1924. Biophysicist.



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INTRODUCTION

HYPERTENSION which at the present time is so prevalent and extensively recognized is a condition intensified by hyper-cultivation. While modern diagnostic methods are more exact and many more cases than heretofore are recognized, it is a fact that hypertension is on the increase.

By many physicians hypertension is thought to be a condition wisely provided by nature as a compensatory measure. Cardiac hypertrophy does not **per se** cause increased blood pressure, neither does impeding the circulation through the kidneys cause hypertension.

Increased blood pressure is a premonitory indication of pathological changes yet to come, and is not, as has been supposed, the result of arterial changes.

While it is the desire of the writer not to exaggerate the danger of this condition, he feels it to be sufficiently dangerous to give rise to alarm. Over two million persons within the United

States are known to be suffering from organic heart disease, seventy-five per cent of which is preceded by hyperpiesia. Adding to this number the cases not classified with heart disease, together with a greater number of unknown cases makes a total that is almost appalling. A conservative estimate of the number of cases of hyperpiesia and hypertension in the United States would place the number at several millions. The number of deaths in which hyperpiesia is concerned as an etiological factor far exceeds those from any other disease. The importance of the causes of hypertension as morbific agents is of the same order as that of cancer and tuberculosis combined.

Deaths in 1922

Tuberculosis	114,000
Apoplexy	80,000
Nephritis	90,000
Heart disease	150,000
Cancer	83,000

No longer can there be any excuse for confusion between arteriosclerosis and hypertension. Arteriosclerosis may be the end result of a long continued hyperpiesia, but is never the cause of hypertension. As a general proposition increased arterial tension precedes kidney dysfunction. However, hypertension may be a sequel of acute nephritis.

In uremia of pregnancy the increased arterial tension may or may not be responsible for the condition.

Superficial arteries may be atheromatous while the deep central arteries may be in a normal state. Atheromatous radials may exist without a previous hyperpiesia. General arteriosclerosis may exist with normal pressures, but if it could be known, it is quite probable that hyperpiesia was an important factor in its development.

ARTERIAL TENSION

THE terms "high blood pressure," "hypertension," "hyperpiesia," "essential hypertension," "hyperintensive cardiovascular disease" are to depict a condition of vascular tension. These terms should not be used indiscriminately. For the purpose of clearing the analogy of these terms the following definitions are assigned:

HIGH BLOOD PRESSURE may mean any condition characterized by increased vascular tension.

HYPERTENSION is a condition of the vascular system characterized by a persistent and continuous elevation of the systolic and diastolic blood pressures, and the use of the term should be limited to cases with discoverable vascular lesions. These lesions are usually of the sclerotic type and occur in the heart, kidneys or brain, but may occur in any part of the vascular system.

HYPERPIESIA or HYPERPIESIS is a condition characterized by a persistent elevation of blood pressure **without** discoverable cardiovascular changes.

ESSENTIAL HYPERTENSION. The use of the term "**essential** hypertension" is unfortunate. Webster defines the word essential as necessary to the existence of a thing. To man's existence hypertension is no more essential than headache.

Hyperpiesia is a symptom of impaired physiology. Hypertension means pathologic physiology.

Increased vascular tension is the cause, not the effect of pathological changes.

Hyperpiesia is the most constant causative factor in myocarditis.

Hyperpiesis is not **per se** produced by heart force, but rather by the condition prevailing in the blood vessels, chiefly in the arterioles and capillaries. Loss of elasticity of the arterial walls calls for increased heart force to overcome the resistance.

HYPOTENSION is a condition of the vascular system characterized by a persistent decreased vascular tension and is usually accompanied with a definite pathology.

This book is interleaved for the convenience of the physician in making notes on his cases and commenting on the statements made by the author.

Constructive Criticism Invited

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Hypotension is the rule in psoriasis, lichen planus, erythematous lupus, acute infections and tuberculosis.

Causative factors in hypotension in order of frequency are: diseases of the digestive tract, diseases of the vascular system, infections and psychoneuroses.

Complaints of patients with hypotension in order of frequency are: exhaustion, nervousness, headache, indigestion, constipation, numbness of the extremities and vague abdominal pains.

An occasional high systolic pressure has no particular significance; only a persistent pressure above normal constitutes hyperpiesia.

Hyperpiesia is the advance agent advising us of approaching cardiovascular lesions.

Hyperpiesia is an etiological factor in nearly all cardiovascular pathology.

A long period of time is essential for hyperpiesia to induce cardiovascular changes.

There is no condition so insidious as hyperpiesia.

Hyperpiesia is now considered to be the primary cause of structural changes in the arteries.

Whenever hyperpiesia exists, it may be known that in the course of time cardiac hypertrophy will follow unless the condition is removed.

The argument that an increased arterial tension is compensatory and should not be combated will not hold good as the condition antedates by months and even years the cardiovascular lesions.

The causes of hyperpiesia exist long before the person becomes a patient and aware of his condition. When symptoms such as headache, digestive and urinary disturbances appear, considerable damage will have already been done. The case has passed from the first stage of hyperpiesia to the second stage or hypertension.

The correction of hyperpiesia in its incipiency is of prime importance to the individual and the first duty of the physician.

Patients should be urged to have their blood pressures taken at stated intervals. Prophylaxis postpones postmortem.

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Normal Blood Pressures

Blood pressure depends upon six factors:

1. Heart force.
2. End resistance.
3. Elasticity of the vessel walls.
4. Amount of blood.
5. Viscosity of blood.
6. Vasomotor control.

These essentials vary widely under various conditions all of which are set forth in modern works on physiology.

To possess a general idea of what the normal pressures should be in any particular individual is not only desirable but must be closely approximated to be of value in diagnosis, prognosis and treatment.

While the systolic pressure, taken alone, may give some idea of the vascular tension it is of little value in interpretation.

The diastolic pressure is a better guide to diagnosis than the systolic.

A high systolic suggests functional disturbance; a high diastolic suggests pathologic changes.

The systolic is easily influenced by the following conditions:

POSITION OF THE BODY. About 4mm higher in standing than sitting posture. About 4mm lower in recumbent than sitting posture.

LOCALITY. About 4mm difference between the right and left side arteries. About 5mm difference between the brachial and femoral artery.

TIME OF DAY. Lower in the forenoon than afternoon.

EXERCISE. Higher immediately after exercise, but should return to normal within ten minutes, all depending upon the intensity of the exercise. Exertion followed by fatigue lowers the pressure which should return to normal within one hour.

DIGESTION. A fall immediately after a meal followed by a gradual rise, reaching the maximum about one hour after the meal. A cup of coffee or tea will raise the systolic pressure from four to fifteen points.

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SLEEP. During sleep the systolic pressure usually falls to below 100mm. Normal pressure during sleep is about 94mm. Blood pressure elevation due to functional disturbances while awake is wiped out during sleep. Blood pressure elevation due to pathological changes while reduced will be found to be over 100mm during sleep.

PAIN. Intense pain will always increase blood pressure—the greater its intensity the greater the elevation. Gastric crises of tabes will often raise the systolic pressure 70 to 80mm Hg. Hysteria and malingery have no effect upon arterial tension.

EXCITEMENT, ANGER, ETC. A sudden rise which may continue for twenty-four hours.

FEAR. Usually followed by a fall in systolic pressure.

AGE. The old dictum that the systolic pressure may be estimated roughly by the formula, age plus 100 in the case of men, and in the case of women

age plus 100 less five per cent is, to say the least, decidedly inaccurate.

The age of the patient should receive the least consideration in the estimation of a normal blood pressure. It is well known that added years also add many changes in the arterial tree, not through age alone, but by reason of inside and outside influences such as over-exertion, errors in diet, faulty hygiene, psychic influences, etc. There is no good reason for an individual at the age of seventy years who has passed a normal life, to experience a blood pressure materially higher than when twenty-five years of age.

BUILD. Height and weight must be considered in the determination of normal blood pressures. An individual five feet four inches in height weighing 120 pounds will necessarily have a lower normal pressure than one of the same height weighing 160 pounds. An individual six feet in height who weighs 165 pounds will not have the same pressure as one whose height is five feet eight inches and weighs 165 pounds.

It is impossible to announce a formula or table of normal pressures which could be considered ac-

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curate. However, it is quite within the limits of safety to consider the normal systolic pressure in adults to be between 110 and 140mm Hg., regardless of age, sex, height or weight and a normal diastolic between 74 and 90. There may be variations in these figures and the individual be in good health.

The Mutual Life Insurance Company of New York, from experience based upon 150,000 risks who were accepted, has placed the systolic pressure of healthy men of all ages and builds between 114 and 142.

The Systolic Pressure

Is equal to the diastolic plus the pulse pressure and represents the force of the heart to drive the blood through the arteries. The diastolic pressure represents the tension which the arterial walls exert upon the blood; it is the pressure that the left ventricle must overcome before the aortic valve opens. The systolic and pulse pressures show heart values and the diastolic pressure shows end resistance.

The relation of the three pressures should not vary much from 1, 2, 3. Pulse pressure 1, diastolic 2, systolic 3. The typical normal pressures being systolic 120; diastolic 80; pulse pressure 40 together with normal pulse rate.

A sustained systolic of 115 with a diastolic of 60 (P. P. 55) may be compatible with fairly good health.

The normal pulse pressure of all adult individuals regardless of age, sex and build varies from 39 to 50.

Cadbury's observations on blood pressure of the Chinese (China Medical Journal, Shanghai, Oct. 23, 1923) shows that the systolic pressure averages 20mm. less than the normal for people of Europe and North America. The diastolic pressure of the Chinese is also lower than the normal of individuals of other countries. It is a remarkable fact that hypertension in Chinese is very unusual. While chronic nephritis is very common it is seldom accompanied with hypertension. Low blood pressure in Chinese is probably due to their small stature, light weight and low diet.

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ETIOLOGY

THE causes of hyperpiesis are not definitely known. However, considerable testimony has been amassed from which we are tentatively assured that the principal cause lies in certain toxic substances circulating in the blood, and that exclusive of specific toxins these substances are of gastro-intestinal origin.

Intestinal stasis weakens the natural defense of the intestinal mucosa against bacterial invasion, hence absorption of toxins, vasomotor disturbance and hyperpiesia.

Too much fuel (food), deficient combustion and defective elimination are responsible factors in the etiology of hyperpiesis.

Overactive adrenals and pituitary often increase arterial tension.

Allbutt says: 'Alcohol, save of the liberal table, has little or nothing to do with the causation of hyperpiesis."

Hypertension often harks back to childhood.

Meakins and Harrington have found histanin, the amin from the amino-acid histidin, in intestinal stasis of man. It is possible that this product be one of the essential factors in arterial tension.

Moschowitz says: "Essential vascular hypertension (hyperpiesia) is not the result of arteriosclerosis or nephritis; arteriosclerosis itself may be the product of a persistent hypertension or the same cause which brings on the hypertension." The same views are shared by Allbutt and others.

Riesman believes that some endocrine disturbance is responsible for increased vascular tension, occurring at the time of the menopause.

Heredity is as an important factor in most cases of hyperpiesia.

Most authorities agree that long-continued infections are responsible for many cases of hyperpiesia. Experience leads the writer to believe that acute infections are more often accompanied with **hypo** than hypertension.

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Acute infections seem to play a more important role in valvular diseases of the heart than myocardial affections. Hyperpiesis is not a frequent factor in the etiology of valvular disease, yet an important one in myocardial disease.

Barach says: "In the female, chronic tonsillar and upper respiratory infections produce a picture of dysthyroidism, in the male the same infections are found associated with the clinical picture of neuro-circulatory asthenia, and this condition occurs in persons who are the product of a bad heredity plus severe or oft-repeated infection."

Barach also says: "Patients giving a history of neurocirculatory asthenia when young and of hypertension in middle life constitute, in my experience, the larger portion of the essential vascular hypertension group. This group of cases serves as a connecting link between the infections of early life, which are followed by neurocirculatory asthenia and the hypertension of later life, which is preceded by neurocirculatory asthenia."

Allbutt says: "Of the causes of hypertension we know nothing. It seems to be a disease of the

well-to-do class, or whose fathers have indulged good appetites."

While we do not know what etiological factors are concerned in any particular case, it might be said that we are learning.

There is no one etiological factor to which we may point and say that it is always a cause of hyperpiesia. What seems to be a rational explanation of the cause in one person may not hold good in another.

The effects of tobacco on blood pressure depend entirely upon the effects of tobacco upon the nervous system. Hypotension occurs as often as hypertension in men addicted to overindulgence in tobacco.

Damaged blood vessels due to syphilis often cause hypertension.

Excess water drinking in itself may cause elevation of the systolic pressure. Again, if the in-

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creased water intake increases urine excretion, high arterial tension may be lowered.

Ill-advised exercise "to keep fit" is a frequent cause of hyperpiesia and later on heart failure.

While increased arterial tension not infrequently coexists with a gouty symptomology, it cannot be said that gout **per se** is a cause of this condition, yet, an inquiry into the patient's family history will often reveal many cases of gout and rheumatism.

While protein substances are not directly concerned in blood pressure elevation, it is the consensus of opinion of cardiologists that intestinal toxemia arising from intestinal stasis is a frequent cause, perhaps the most frequent cause of hyperpiesis.

The rate of urine flow depends largely upon rate of blood flow and blood pressure. However, in kidney dysfunction hypertension should be visualized more as an etiological factor than a measure of compensation.

There is no doubt about the mental condition having a great deal to do with the stability of the vascular system and its effect upon blood pressure.

The effects of altitude upon blood pressure vary greatly according to man's physical condition at the time of the ascent. The strain upon the circulatory system imposed by altitude is very similar to that induced by extreme muscular exercise. In an ordinary healthy individual there is little or no effect upon his blood pressure until an altitude of 8,000 feet is reached. There is practically no difference in the blood pressure of healthy individuals at sea level or an altitude of 7,000 feet. Individuals with high pressures who have arterial changes in the form of sclerosis and those with poor vasomotor control do badly in altitudes above 8,000 feet.

Neurasthenia usually is accompanied with hypotension. However, many neurotics experience an increased arterial tension.

The high mortality rate from chronic nephritis in the United States may be due to excessive pro-

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tein consumption. In countries where the protein consumption is low the mortality from chronic nephritis is correspondingly low.

Allbutt says: "I feel sure that hyperpiesia is hereditary; the moderate man of today may suffer by his own excesses, or for the luxurious living of his forefathers."

Biochemical findings in the blood, up to the present time, have shed no light upon the causes of increased arterial tension, yet, further studies may make possible a differential diagnosis.

Below the age of 50 hypertension is more common in men than women; after the age of 50 the number of cases are about equal.

While the heart is the prime factor in starting the circulation its maintenance largely depends upon the resistance offered by the arterioles and capillaries.

The prime changes in the lumen of the blood vessels are principally if not wholly due to the action of the vasomotor mechanism.

Synchronism of the endocrine glands is necessary to a normal circulation.

High arterial tension may result from spastic contraction of the external layer of the large blood vessels. This phenomenon may be due to excitation of the sympathetic nerves with which this muscular layer is richly supplied.

A purely local hypertension is sometimes encountered in the hands, feet and portions of the face. To this form of capillary tension Cordier has applied the neonym **acrocyanosis.** Cordier says: "The primary cause seems to be some toxic action on the vasomotor centers."

A systolic of 120 in the aged should not be considered hypotension.

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THE SPHYGMOMANOMETER

FOR many years the sphygmomanometer was considered with laboratory interest only. Science in medicine makes haste slowly. The paper on the circulation of the blood by William Harvey was contributed in the early part of the seventeenth century. About one hundred years later Stephen Hales, a preacher, probably was the first to measure blood pressure by inserting a goose quill into an artery of a horse and noting the height to which the blood rose. This experiment formed the basis of the studies in blood pressure. About one hundred years later (1828) appeared the first mercury manometer. About fifty years later or in the latter part of the nineteenth century a device called the cardiograph was employed as a scientific instrument by investigators in physiology. The present century has witnessed great improvements in the sphygmomanometer.

While there are several types of blood pressure registering devices only two are now in general use; one, a column of mercury, and the other built

on the principle of the aneroid, both recording the pressures in millimeters of mercury.

The interpretation of signs elicited through the aid of mechanical diagnostic devices is liable to be faulty. Based upon the readings of the sphygmomanometer many conditions are erroneously assumed to be present; nevertheless, it is one of the most useful diagnostic aids in our armamentarium. It is to the physician what the steam gauge is to the engineer and the mariner's compass to the captain of the boat. As an assistant in the diagnosis and prognosis of human ailments the sphygmomanometer equals the clinical thermometer in usefulness to the physician.

A combination of many influences is ever active in the etiology of circulatory conditions and many mathematical contrivances have been devised for the elicitation of these potencies.

While the stethoscope, the polygraph, the electrocardiagraph, the arteriometer and sphygmomanometer are important agencies and each is valuable in the elicitation of certain conditions, no one

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nor all of them can be depended upon to tell the entire story.

The readings of these devices properly interpreted will visualize a picture of cardiovascular conditions, which, prior to their discovery, was an undeveloped film. The knowledge gained through the proper interpretation of their readings enables us to foresee the changes yet to come in the arterial tree. During the period of hyperpiesia or prevascular change, if we are prepared with modern equipment, pathological changes may be averted.

Methods of Taking Blood Pressure

Methods employed in taking blood pressure vary greatly. To those who still adhere to the readings visualized by the oscillations of mercury the writer desires to say that while these oscillations may give some evidence of the heart's action they cannot be depended upon to reveal either the systolic or diastolic pressure.

The most approved method of taking blood pressure is as follows:

The brachial artery of the left arm is the one of choice. All constricting clothing should be re-

moved, muscles relaxed, and arm at ease and supported on a table, whether the recumbent or sitting posture be chosen. The cuff should be at least five inches in width and applied snugly to the arm above the elbow, making sure that it does not impinge upon the elbow joint; place the stethoscope over the artery immediately below the cuff, inflate the sleeve until at least ten points above where all sound ceases is recorded, then allow the air to escape slowly until a distinct "click" is heard. This point is recorded as the systolic pressure. Some faint sounds usually become audible before the "click" is heard. Some physicians register the first sound as the systolic pressure; when so registered the reading is from two to eight points too high.

To obtain the diastolic pressure, the valve is slightly opened, the air allowed to escape gradually, and at the point where all sound ceases is noted close the valve, inflate the sleeve and check the systolic reading again; open the valve and check the diastolic reading. The diastolic is sometimes difficult to read; if the air is allowed to escape from the bag too rapidly the diastolic reading will be too high. When the point at which all sound

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ceases is registered it is a good plan to wait a few second when often the sound recurs, then slowly open the valve and make a new reading which will be the correct one. To make sure, it is well to check the readings the third time. All readings should be made in the sitting, standing and lying postures.

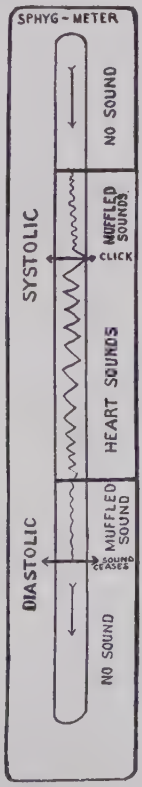

Diagram illustrative of sounds heard in taking blood pressures when reading downward

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ENERGY INDEX

IT is important to know the total amount of energy spent by the circulatory system in a minute or an hour. This information is of value in cases where we suspect the giving-way of the vessels—such as apoplexy and other hemorrhages.

To the method of obtaining this information Barach has applied the neonym "Energy Index." He says: "From the pulse rate we know how many systoles and how many diastoles to each minute there are in the arterial tree." For example, if the systolic pressure is 120mm., the diastolic pressure 70mm. and the pulse rate 72 per minute, the energy exerted in one minute would be:

In diastole 70x72 or 5,040mm. Hg.

In systole 120x72 or 8,640mm. Hg.

In both 190x72 or 13,650mm. Hg.

The energy index is obtained by multiplying the sum of the systolic and diastolic pressures by the pulse rate. Repeated experiments show that the maximum energy index consistent with safety to the vascular system is 20,000mm. of mercury. The

normal index range is from 13,000 to 20,000. When less than 13,000 general cardiovascular weakness is suggested; when above 20,000 an excessive circulatory load is being carried.

A careful consideration of blood pressures, pulse rate and energy index will yield an abundance of information of inestimable value in arriving at a diagnosis of many pathological conditions.

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PROGNOSIS

IT is extremely unwise to proclaim a prognosis in any case of hypertension. The final outcome largely depends upon the predisposition of the patient. The tendency of those who suffer from mental strain is toward a cerebral accident; the overfed, to kidney complications and the physically overworked to myocardial failure.

The life of the individual with hypertension depends not so much upon the degree of hypertension as upon his inherited tendency. If he be well born he may carry a high vascular tension for many years without serious inconvenience. On the other hand, he often succumbs to the weaknes of his forebears which tends to cardiac failure, a giving away of the smaller blood vessels of the brain or to the complications of nephritis.

After hyperpiesia has continued for some time, albumin may appear in the urine, but this does not signify more than a passing renal hyperemia. After cardiac dilatation develops, the renal capacity

becomes more and more influenced and uremic symptoms supervene; yet, these symptoms may be relieved time and again by proper treatment.

The prognosis, in hyperpiesia, should not be based upon the height of the blood pressure. Hereditary tendency and personal history are better guides.

Errors in diet, frequent attacks of tonsillitis, needless exposure predispose to kidney failure: rheumatic fever, pneumonia, diphtheria, etc., to cardiac failure; diseases of the nervous system, mental strain, etc., to cerebral accidents.

The tendency toward certain diseases in a family is a valuable guide in prognosis.

Among the causes of death in which hypertension is an important factor, statistics show that about sixty per cent is due to cardiac failure, twenty-five per cent to kidney failure and fifteen per cent to cerebral accident.

A persistent diastolic pressure above 90 should be viewed with suspicion; above 100 means path-

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ology somewhere in the arterial tree, the condition having passed the hyperpietic stage into true hypertension.

A sustained diastolic of 130 or over which cannot be reduced suggests a fatal termination within two to three years.

A progressive hyperpiesia demands immediate attention.

A minimum systolic of 110 and a maximum diastolic of 90 give a pulse pressure of 20; such an individual may be in good health, yet, a weak myocardium and arterial changes may be anticipated if this ratio persist for an extended period of time.

The mortality rate as shown by insurance companies increases in leaps and bounds as the systolic pressure exceeds 140; at 150 the increase in mortality over normal reaches 34 per cent and at 160 and over to 400 per cent. It is also the experience of life insurance companies that overweight makes for increase of mortality and when combined with high arterial pressure makes for a very high rate of mortality.

A twenty per cent variation of the pulse pressure either below the minimum or above the maximum of normal should be regarded as at least suspicious of cardiovascular changes.

A perfect heart cannot maintain a perfect circulation of the blood with impotent arterial walls.

Loss of elasticity of arterial walls necessitates greater cardiac effort to overcome the resistance, and cardiac hypertrophy must follow. Hypertrophy gradually gives way to dilatation and eventual heart failure.

Faught says: "The cardiovascular system is involved to a more or less extent in the majority of diseased conditions."

High arterial tension, though intermittent, if not corrected will cause disease.

A persistent systolic pressure of 150 at any age will in time induce albuminuria.

In hyperpiesia the systolic pressure is high during the day but falls to nearly normal during sleep.

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The heart work done by an athlete playing football for a period of three hours is not equal to one carrying a systolic pressure of 180 for the same time.

A rapid decline in all pressures in cases of hypertension suggests arterial degeneration and myocardial failure.

Increased arterial tension contemplates decreased metabolism.

As the systolic pressure increases the efficiency of the heart decreases.

Constant pulmonary stress will cause myocardial failure of the right side of the heart without hypertension being present.

Practically all cases of chronic myocarditis are caused by hyperpiesia, and are associated with high systolic and diastolic pressures.

Among the causes of heart disease deranged metabolism appropriates first place. Infections take

first place among the causes of diseased valves of the heart.

While many diabetics have arteriosclerosis accompanied with hypertension, it is not probable that the blood sugar is an etiological factor in the hypertension.

While a rapid decline in blood pressure usually precedes heart failure, the reverse is occasionally the case,—the high tension continuing until the end.

When the systolic pressure reaches 140 in a pregnant woman otherwise normal, eclampsia is to be anticipated.

Normal systolics, high diastolics with diminished pulse pressures are common after apoplexy.

When the pulse rate is higher than the systolic pressure expressed in mm. of mercury the circulatory equilibrium is seriously disturbed.

Hyperpiesia may exist for a long time before doing injury to a well-inherited arterial tree.

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The symptoms and signs of arterial degenerative sclerosis differ materially from those of hyperpiesia.

It was observed by Merchand that to men who worked hard with their limbs arteriosclerosis in the limbs was apt to arise. This local manifestation should not be taken as a sign of general arteriosclerosis.

A fluctuating difference in the systolic pressure of 15 to 20 mm. Hg. is of little significance.

In aortic regurgitation the systolic pressure is high and the diastolic low. A fall in the systolic pressure in this condition forebodes danger.

Save at its onset, the arterial tension in hyperthyroidism is usually low, while in hypothyroidism the tension is usually high.

The greater the difference between the systolic and diastolic pressures, the greater the heart load and danger of heart failure.

In chronic interstitial nephritis a persistent rise or sudden lowering of the systolic pressure is indicative of heart failure.

In angina pectoris the pressure is usually high, when the pressure falls during a paroxysm the prognosis is grave.

A sudden rise in pressure in chronic nephritis points to uremia.

Low diastolic pressure in children is due to the elasticity of the arterial walls, therefore should not be considered pathologic.

The fact that a child's systolic pressure is easily influenced by emotion should always be considered; a turbulent temper is often responsible for a turbulent blood pressure reading. Repeated readings of blood pressure are more important in children than adults.

A fall in systolic pressure after exercise suggests myocardial insufficiency.

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A continued pulse pressure of over 50 or under 30 calls for repairs.

Blood pressures are not always high in arteriosclerosis.

Arteriosclerosis is often a local disease.

Thyroid activity prevents arteriosclerosis.

In whooping cough the systolic pressure is high; during a paroxysm the pressure may reach an intensity to cause a rupture in the walls of small vessels.

Much knowledge of the condition of the heart may be gleaned from blood pressure readings in acute infectious diseases.

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INTERPRETATION

UNDER normal conditions the pressure exerted upon the blood vessels gives rise to no sensations other than those of comfort and well being. Materials used in the workshops of growth and repair as well as the waste material pass through the vascular system without subjective effects; however, there are many times when this happy state of affairs is upset by a multiplicity of causes. While for a time and often a long time the systolic pressure may be quite high the individual experiences no discomforture, but rather a feeling of exhiliration. From such individuals is often heard the expression "never felt better in my life."

The increased blood supply to the brain stimulates its activity during which period the individual is often enlivened to a state of joyful exhuberation.

The chronologic data of high blood pressure runs something as follows:

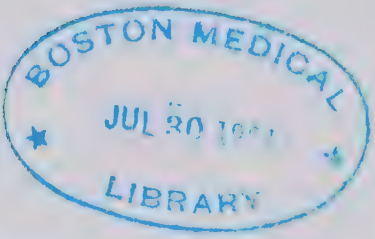
1. Defective metabolism resulting in the formation of pressor substances which enter the circulation and stimulate the pressor nerve fibers to overactivity.

2. Hyperpiesia due to spasm of the arterioles.

3. Hypertension with cardiac hypertrophy.

4. Kidney dysfunction, intracranial tension, retinal changes, etc.

5. Chronic myocarditis and nephritis.



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PULSE RATE COMPARISONS

THE picture presented by the systolic and diastolic pressures is not complete without comparison with the pulse rate as the following examples will show. A normal systolic and high diastolic with high pulse rate suggest myocardial weakness; the same systolic and diastolic with a LOW pulse rate suggest the opposite—cardiac hypertrophy.

A low systolic, normal diastolic and normal pulse rate suggest neurasthenia or nervous bankruptcy, while the same systolic and diastolic with a HIGH pulse rate suggest tuberculosis or other infection.

A HIGH systolic, HIGH diastolic and HIGH pulse rate suggest failing heart, while the same pressures with a LOW pulse rate suggest arterial changes and a competent heart.

A high systolic, low diastolic with a normal pulse rate suggest a weak myocardium while the

same pressures with a HIGH pulse rate point to thyroid intoxication.

Many other examples could be cited but these few show the importance of considering the pulse rate with the blood pressures in differentiating cardiovascular conditions.

Another factor in blood pressure interpretation which is often underestimated is the posture of the patient.

All readings, especially the first, should be taken in the horizontal, sitting and standing positions. If the readings are reversed they indicate vasomotor inefficiency, myocardial weakness or splanchnic stasis.

If there is a rise in PULSE PRESSURE on changing from the horizontal to the standing posture it points to cardiac hypertrophy. In the norm this change will cause a fall in the pulse pressure.

The diastolic pressure normally rises in changing from the horizontal to the standing posture; if it lower look for disease of the heart.

Should there be a fall in all pressures in changing from the horizontal to the standing posture look for cardiac dilatation.

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A continued pulse pressure higher than the diastolic points to failing heart. A high diastolic always means great vascular tension and when constant points to cardiovascular degeneration and probable cerebral accident.

A normal systolic and pulse rate with a very low diastolic suggest aortic insufficiency.

A very high systolic and diastolic with a low pulse rate suggest arteriosclerosis.

A high systolic, high diastolic with low pulse pressure and high pulse rate suggest failing myocardium.

A low systolic, normal diastolic and pulse rate suggest neurasthenia.

A low systolic and normal diastolic with increased pulse rate suggest cardiac insufficiency.

A low systolic and low or normal diastolic with increased pulse rate suggest infection.

A low systolic and diastolic with increased pulse pressure suggest abnormal relation of the components of the blood as met with in anemia.

Systolic pressure is easily influenced by physiological factors, while the diastolic is not so easily influenced. Systolic and pulse pressures show heart values; diastolic shows end resistance.

In myocardial degeneration with or without arrhythmia there may be high arterial tension, but sooner or later the pressure falls. In such cases if the pulse pressure be much over 50 per cent of the diastolic, look out for heart failure.

In myocardial disease mild exercise will be followed by a fall in the systolic pressure. If the heart is competent there will be a slight rise in the pressure.

In cases of nerve exhaustion the systolic pressure may be lower in the standing than in the sitting posture.

Systolic pressure may be high in cases of weak heart due to the action of the vasoconstrictors in an effort to compensate for cardiac insufficiency.

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In aortic incompetency there is a high systolic and low diastolic pressure.

In mitral stenosis the systolic pressure is low due to the small amount of blood passing from the auricle to ventricle.

In valvular diseases of the heart the blood pressures are often normal.

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TREATMENT

IT has been said that the worst thing we can do is to treat the symptom, **hypertension.** We appreciate the importance of generalizing the disease and individualizing the patient and in no condition is this more pertinent than in hypertension.

During the stage of hyperpiesia, when no pathology is discoverable, what are we to do; fold our hands and be content with the idea that an increased arterial tension is a compensatory measure and should not be combatted? The writer grants that in a few cases a slight increase in the systolic pressure seems to serve a useful purpose. He also desires not only to add that a constant systolic pressure above 140 or a diastolic above 90, if not corrected, forebodes danger, but wishes to go on record in saying that the condition known as hyperpiesia can be corrected by the proper application of the high frequency current combined with common sense hygienic measures.

Until we acquire a more definite knowledge of the causes of hyperpiesis, its treatment must be

more or less empirical. However, during the first stage autocondensation has proven satisfactory to the writer.

The management of the second stage, hypertension, with well defined pathology, is an entirely different matter. While we still employ autocondensation to keep the pressures within the zone of safety, no therapeutic measure known to possess value should be neglected.

Physiologists tell us that digitalis is a vasoconstrictor and raises blood pressure. In the writer's experience with hundreds of cases of hypertension no such action has been observed. Where indicated there can be no objection to its use in conjunction with autocondensation or any other physiotherapeutic measure.

Subcutaneous administration of adrenalin often lowers the systolic pressure in hyperpiesia and raises it in glomerulonephritis.

Caffein will raise the systolic without a corresponding rise in the diastolic pressure, therefore, is contraindicated in hyperpiesia.

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Atropin is a vaso-dilator and theoretically should lower the systolic pressure, but no such action has been observed in hypertension.

Glonoin and other nitrites are powerful vaso-dilators and always lower the systolic pressure, but these effects are ephemeral and their prolonged use does more harm than good.

Potassium iodid often lowers the systolic and sometimes the diastolic pressure, but during a prolonged administration the potassium content irritates the kidneys and often causes albuminuria. Iodin alone is advisable when syphilis is known to be an etiological factor in hypertension, but as a routine measure iodin has but little influence upon blood pressure.

Theoretically adrenalin is indicated in hypotension, but it is of little practical use in this condition.

As the quantity of the blood is one of the primary factors in blood pressure, venesection is sometimes advisable to avert a cerebral accident, but it

cannot be relied upon to keep the pressure within the safety zone without serious effects upon nutrition; the same may be said of magnesium sulphate. The diuretic and cholic effects of calomel are important in the reduction of blood pressure, but unfortunately can be administered only at irregular intervals.

The objectionable features of the drugs just mentioned except in emergencies preclude their use. This being true, to what may the physician turn with the expectation of relieving this most common complaint?

The high frequency current in the form of autocondensation, diathermy and its monopolar application; hydrotherapy for its vasomotor effects; the wave current for intestinal stasis, equalization of the splanchnic circulation and exercise, each under indications of its own will render a valuable service in the management of high arterial tension.

Autocondensation Effects

Oxygen carrying power of the blood is increased.

Increases hemoglobin.

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Increases oxidation.
Increases elimination of waste products.
Increases cellular activity.
Increases phagocytosis.
Raises body temperature.
Balances vasomotor control.

Its effects upon high arterial tension are quite prompt, one treatment often reduces the systolic pressure from 10 to 50 mm. Hg. In the course of twenty-four hours the pressure usually returns to within five or ten points of the previous day. In hyperpiesia the results are prompt and lasting, on the other hand, in cases of cardiovascular changes the reduction of pressure is not so marked and has a greater tendency to return, but even in these cases the reduction is progressive from day to day until the point of fixed tension is reached. Fixed tension will be found to be considerably above normal in every case of cardiovascular changes.

Fixed tension is the point at which no further reduction can be realized.

Faught says: "Hypertension of the vascular system is a condition in itself that demands spe-

cific treatment, irrespective of what the underlying clinical picture may be. The treatment for the basic causative factor varies, of course, with the nature of the complications."

All persons inclined to apoplexy should be under observation and treatment instituted whenever there is a rise in arterial tension.

Autocondensation widens the blood channels and lightens the labor of the heart, consequently it lowers arterial tension.

Patients who are overweight and have a high systolic pressure are benefited by a low calory diet with a high percentage of proteins, plus autocondensation.

The nervous phenomena from which women suffer at the period of the menopause are often relieved by autocondensation.

An autocondensation dose of 300 to 600 milliamperes should never be exceeded in cardiovascular disease.

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A high systolic pressure can always be reduced by autocondensation but it cannot always be maintained.

In hypertension a salt-free diet is better than a protein-free diet.

A limited amount of animal protein is advisable in most cases of hypertension.

The diet should be the minimum quantity compatible with health. Only bad effects result from starvation.

A diet weighed by common sense is better than one weighed in calories.

Relief of constipation is of prime importance in the management of high arterial tension, and is often relieved by the wave current.

Moderate exercise is useful; if the patient will not exercise, it should be done for him with the wave current.

Clinical experience teaches that treatments by autocondensation often repeated over a long period of time will soften sclerosed blood vessels.

Patients should not be treated by autocondensation within the period of two hours after a meal.

A common fallacy is that hypertension is essential to myocardial and kidney efficiency. Hypertension hinders the circulation through the myocardium and kidneys. It is easily demonstrated that lowering the arterial tension increases myocardial efficiency. Shackleford has shown that the urinary output as well as a diminuation of albumin and casts are accomplished by lowering the blood pressure.

Untreated patients with hyperpiesis are subject to the dangers of kidney and brain disease.

Hyperpiesis from any cause is greatly benefited by sweat baths; hypertension is seldom benefited by any kind of baths.

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Disturbances of metabolism are almost always found to be the leading factors in disease. It is therefore evident that permanent curative results cannot be obtained without a correction of the metabolic disorder.

Kellogg says: "Electricity influences metabolism in three different ways. First, by inducing chemical changes in the fluids of the body and stimulating cell activity; second, by raising or lowering the temperature of the tissues, thus bringing into action one of the most powerful of vital stimulants; third, by invoking muscular contraction and thus irritating the series of remarkable metabolic activities which are associated with muscular movement. Muscular movements may be induced by galvanic, faradic or static currents, but the sinusoidal will be found to be most convenient and effective."

Watchful waiting of individuals with high blood pressure is too often the attitude assumed by the physician. Watching a burning building and waiting for the consummation of its destruction may be interesting, but when applied to a gradual and per-

sistent rise in blood pressure is nothing less than criminal—not only vigilance but action is demanded in these cases.

Diagnostic skill often prevents health preservation.

During convalescence from acute infections, rest in bed should be insisted upon until the blood pressure readings indicate the patient's return to normalcy.

A stereotyped book-made dietary to be followed in every case of high arterial tension is as foolish as it is inefficient. The peculiarities of each patient should always be studied before a menu is prescribed. "What's one man's food may be another's poison."

Hyperpiesia in children is easily controlled by proper hygienic measures. A blood pressure record should be made and kept of every pupil attending the public schools.

The correction of circulatory disorders of children makes good not only for this generation but

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those to come. The fact that children of today are the grandfathers and grandmothers of tomorrow should not be overlooked. Today's error is tomorrow's calamity.

Hyperpiesia will exist so long as there is an intake of intestinal toxins. Therefore a rational control of food intake and a regulation of perverted peristalsis are requisites in the management of high arterial tension.

In hyperpiesia the success of treatment lies in the removal of the causative factor which is often difficult of accomplishment. While searching for the etiological factors the tension should be reduced by autocondensation, the alimentary canal cleared and diet and habits corrected; if these things are done the chances are eight to two that no further search will be necessary.

Allbutt says: "The best symptomatic remedy is the high frequency current and its effects persist for some time—longer as the treatment continues."

While thyroid substance is known to increase arterial tension, its combination with ovarian ex-

tract will often lower the tension in women after the menopause.

Costal breathing exercises and sinusoidalization of abdominal muscles favorably influence high arterial tension.

The idea that the reduction of high arterial tension is often dangerous comes from experience gained in the use of drugs. The tension in any case may be reduced by autocondensation with perfect safety, provided proper technic is followed.

Drugs, except in emergencies, should not be used to reduce arterial tension. Venesection is the best temporary remedy when prompt reduction of pressure is demanded.

Commercial food exploitation is a menace to the human race.

Any food faddist can point to special literature that will corroborate his theory.

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Soups should be deleted from the menu of those who suffer from high arterial tension.

While epsom salt is often necessary to clear the food tube of offending material, its daily use is to be deprecated.

The time to treat high arterial tension is during the hyperpietic stage when it can be restored to normal. The longer it has continued the more difficult it is to relieve.

The effects of treatment on hypertension depend upon relief from its complications.

The close relationship between hyperpiesia and intestinal toxemia demands a diet dictated by common sense. Each case must be studied individually and proper diet prescribed.

Excitation of the lower cervical reflexes will temporarily raise a low blood pressure.

Excitation of the upper dorsal reflex will temporarily lower blood pressure.

Hypertension and hyperthyroidism are closely related to cardiovascular disease and the treatment of each is essentially the same.

In over ten thousand treatments of hyperpiesia and hypertension by autocondensation the writer has not observed a single injurious effect.

The theory that high blood pressure is essential to maintain the nutrition of the heart muscle is not supported by facts. In angina pectoris the pressure is usually high and the heart muscle undernourished. Autocondensation will lower the pressure within the heart and increase the diastolic pause, thus permitting a larger amount of blood to reach the heart muscle.

No fear of reducing the natural resistance to tuberculosis by autocondensation should be entertained; whenever high arterial tension coexists with tuberculosis there is kidney or vascular pathology and autocondensation is indicated.

The relief of hypermotility of the stomach and intestines will often lower blood pressure and allow a weak heart to recover.

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Autocondensation lowers blood pressure thus relieving the labor of the heart and other symptoms of impaired circulation.

After a hypertrophic condition of the smaller blood vessels and a mild degree of cardiac hypertrophy has developed as evidenced by a systolic pressure of 170 or less, a normal or slightly elevated diastolic accompanied with a normal pulse rate, the effects of autocondensation, while not so prompt, are satisfactory and a favorable outcome may be expected.

Even after the urinary and blood findings justify a diagnosis of nephritis, the systolic pressure very high and diastolic under 120, with slightly decreased or increased pulse rate, while the cardiovascular condition cannot be restored to normal, much may be done toward prevention of further changes in the arterial tree.

A normal or slightly elevated systolic, high diastolic and high pulse rate suggest a poor myocardium. This condition is best treated by autocondensation, 330 to 450 milliamperes for a period of

10 to 12 minutes; the milliamperage and time may be varied to suit the case, but strong currents must be avoided.

A normal or slightly elevated systolic, a very low diastolic and high pulse rate point to aortic insufficiency. Autocondensation in this condition will probably do more harm than good.

A very high systolic, very high diastolic with a normal or low pulse rate suggest arterial changes. While autocondensation is indicated in this condition, it is advisable to begin the treatment with a low amperage, not over 300, for a period of 10 minutes and gradually increase the dosage from time to time, but 600 milliamperes for 15 minutes must not be exeeded at any time.

In autocondensation the current should be turned on very gradually consuming three minutes to reach the maximum; the current should also be turned off gradually consuming at least two minutes in reaching zero.

Whenever a patient coming from the autocondensation treatment expresses himself as being

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tired, do not forget to prescribe a dose of castor oil to relieve him of the products of increased metabolism.

An enlarged heart whether it be from hypertrophy or dilatation, is reduced by autocondensation.

Autocondensation when given for the sole purpose of lowering arterial tension, a dose exceeding 800 milliamperes for 15 minutes is not justifiable.

Normal blood pressures are little, if any, affected by autocondensation.

All the effects of increased metabolism may be secured by autocondensation without any fall in the blood pressures.

In patients suffering from endocrine dysfunction there may be an immediate rise in all pressures on coming from the autocondensation couch, but this condition will be followed several hours later by a fall.

Autocondensation is usually contraindicated in cases of hypotension; in patients whose temperature is above 100 F.; in advanced arteriosclerosis; in cases after clearing the food tube, fainting, vertigo or sleeplessness occurrs.

In cases where not over 500 milliamperes the chair pad is very convenient and usually satisfactory, but a thick dialectric mattress has the advantage of better diffusion of current throughout the patient and lessens concentration of current at points of poor contact.

No argument should be necessary to prove that a persistently high vascular tension is a serious affair and demands efficient treatment.

The disengorgement of the liver is often essential in the treatment of high vascular tension. This may be accomplished with the aid of diathermy followed by the galvanic wave current.

Hyperpietic hearts will soon recover their normal status by the judicious use of the high frequency current.

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Let it be understood that no claim is made that autocondensation always yields favorable results in hypertension. It has its failures as well as successes, but when employed in the proper manner it is one of the most potent agencies for good at our command in the management of cardiovascular dysfunction.

BLOOD PRESSURE KEY

THE sphygmomanometer as an assistant to the diagnosis of many human ailments, stands high among mechanical devices in usefulness to the physician.

Without argument, it is now conceded by most cardiologists that to be of value in diagnosis, the systolic and diastolic pressures must be considered in connection with the pulse rate.

After years of experience in blood pressure interpretation, the author has designed a "key" to blood-pressure readings for the purpose of assisting the busy physician in arriving at the most probable condition present.

While no claim is made that the key will interpret **all** blood pressure readings, it will, in the majority of instances, suggest the most probable condition present, making it a valuable addition to the equipment of every physician.

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